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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/708,009	02/02/2004	Robert A. Calderoni	BUR920030153US1	2008
29154	7590	04/04/2006		
FREDERICK W. GIBB, III GIBB INTELLECTUAL PROPERTY LAW FIRM, LLC 2568-A RIVA ROAD SUITE 304 ANNAPOLIS, MD 21401			EXAMINER GEORGE, PATRICIA ANN	
			ART UNIT 1765	PAPER NUMBER

DATE MAILED: 04/04/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 10/708,009	Applicant(s) CALDERONI ET AL.	
	Examiner Patricia A. George	Art Unit 1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 24 January 2006.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-17 and 21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-9, 11-15 and 17 is/are rejected.
- 7) ☒ Claim(s) 10, 16 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Response to Amendment***

Amendment dated 01/24/06 acknowledged and filed. Claims 1-17 and 21 are pending in the application. Claims 18-20 have been canceled. Claim 21 has been added. Claims 7 and 17 have been amended to overcome the 35 USC 112 rejection.

### ***Claim Rejections - 35 USC § 112***

Rejections to claims 7 and 17 have been withdrawn, as applicants' amendment dated 01/24/06 these claims to overcome the rejection.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1, 5-6, 9, and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by Winniczek et al. of 6,228,278.

Winniczek teaches all the limitations of independent claims 1 and 21. Winniczek et al. discloses the properties of the plasma itself are changed as target layers are etched bringing about a change in the plasma impedance, which in turn changes the self-induced bias on the substrate. Winniczek et al. further explains the self-induced

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bias on the substrate can change due to the increased current leakage between the plasma (i.e. plasma leakage as in claim 9) and the substrate as the etch features (such as vias or trenches) are etched down to a stop layer. (See col. 3, lines 50-60.) In figure 4, Winniczek et al. discloses a well know (col. 5, line 63) input signal provided to the chamber (238), a comparator circuit, which outputs a control signal (240) for controlling a variable bias compensation power supply (242) (col.5, 48-60). Winniczek et al. discloses a simplified arrangement for monitoring the compensation voltage at node 250 which is input into endpoint monitoring circuitry 402, and outputs a signal of a characteristic change is ascertained. The compensation voltage at node 250 changes as the compensation circuit attempts to keep the currents flowing to poles 208 and 210 substantially equal. Winniczek et al. further teaches it is appreciated that the information contained in the compensation voltage (i.e. impedance indicating the voltage of the chamber, as in claim 5), which is found either in control signal 240 or at node 250 at the output of bias compensation power supply 242, includes information pertaining the progress of the process, particularly pertaining to properties of the plasma itself changing as a change in the plasma impedance occurs, which can change due to the increased current leakage between the plasma (i.e. plasma leakage) and the substrate. As for applicants' claimed limitation "detecting an abrupt change", Winniczek et al. discloses in figure 3, the observance of peak to peak voltage as a method of monitoring the change the plasma (i.e. plasma impedance). Figure 3, shows an abrupt change where the curve is perpendicular to the time line, at about the 117 second point, as in claims 1, and 21.

As to claim 6, Winniczek et al. discloses that although the change is illustrated in FIG. 3 by an increasing compensation voltage, the compensation voltage may change in other ways, such as decreasing, as the etch progresses in other substrates. As the etch clears the target layer, a significant change in the compensation voltage is typically observed. Although the end of the etch is evidenced by a steep upward slope in the vicinity of region 304 in FIG. 3, the end of the etch may also be evidenced (in other etch processes) by a sharp downward slope, a spike or a sudden dip in the signal. Irrespective of the exact shape of the compensation voltage plot at the time the etch ends, the end of the etch is typically evidenced by a clearly discernible change in the compensation voltage. The specific characteristic shape of the compensation voltage plot at the time the etch ends may be ascertained by performing sample etches on sample wafers. Thereafter, the monitoring circuitry may be instructed to look for the ascertained characteristic shape in the compensation plot.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 2, 3, and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winniczek et al. of 6,228,278.

Although Winniczek et al. discloses, in figure 4, a well know (col. 5, line 63) input signal provided to the chamber (238), a comparator circuit, which outputs a control signal (240) for controlling a variable bias compensation power supply (242) (col.5, 48-60), Winniczek fails to explicitly teach the signal is ramped, as in claim 2, either by step or smooth as in claim 3.

However, it would have been obvious to one of ordinary skill in the art at the time of invention was made, that the input signal from a variable power supply (as in Winniczek) would vary either in steps or smoothly, because varying the input would be the advantage gained by using a power supply that is variable.

Therefore the invention of Winniczek et al. teaches an input signal that is ramped, as in applicants' limitations of claim 2, and that the ramped input signal is would be one of step ramped or smooth ramped, as in applicants' limitations of claim 3.

Although Winniczek et al. discloses, see discussion toward claim 6 above, that although the change in peak to peak voltage may abruptly change, and comprise a drop, Winniczek et al. fails to specifically state a drop of 5%, as in claim 7. However, Winniczek et al. characterizes the change illustrated in figure 3 as typical, and clearly teaches that it evidences a steep slope, going on to say that given another type of substrate the sharp slope would be downward.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made, that the slope indicating the change in the peak-to-peak voltage, of Winniczek et al., could be greater than a 5% percent drop, because Winniczek et al. illustrates a 50% change as typical, (which is greater than 5%, as the limitations of applicants' limitations of claim 7) and teaches the direction up or down is dependent on the material of the substrate being processed.

### ***Claim Rejections - 35 USC § 103***

Claims 4, 8, 11, 12-15, 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Winniczek et al. as applied to claims 1 and 5-6 above, and further in view of Hopkins et al. of Plasma Physics Control. Fusion 42 (2000) (B189-B197, printed in the UK).

Winniczek et al. does not teach the input signal is from a RF power supply as in claim 4, and does not teach the configuration monitoring of the impedance through contacts connected to the chamber, as in claim 8, and 11.

Hopkins et al. teaches, in figure 2, a configuration known with the benefit of being sensitive to chemistry changes and being able to highlight plasma instability and confinement (i.e. plasma leakage) problems. Hopkins et al. teaches a method to monitor plasma, through use of a RF power supply (as in claim 4), connected to the process chamber by match unit, then plasma impedance monitor, which monitors the impedance measuring impedance at the contacts connected directly to the process chamber (as in claim 8).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention of Winniczek et al., to use the configuration of Hopkins, a RF power supply and monitoring of the impedance through contacts connected to the chamber, as in applicants' limitations of claims 4, 8 and 11, because Hopkins teaches the configuration is known and has the benefit of being sensitive to chemistry changes and being able to highlight plasma instability and confinement problems.

Although, Hopkins et al. teaches using information generated when maintaining process conditions by measuring plasma properties as a basis for system feedback, which would detect and identify problems, providing more consistent processing, and better usage of the tool by minimizing time it is unavailable due to equipment issues, Hopkins fails to explicitly teach maintaining a history of power levels associated with an onset of plasma leakage for each type of defect, as in claim 17. However, such error tracking systems are known because Hopkins illustrates them in by teaching to measure plasma properties as a basis for system feedback.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of invention was made, to maintaining a history of power levels associated with an onset of plasma leakage for each type of defect, as applicants' claimed limitation, when measure plasma properties as a basis for system feedback, as Hopkins et al., because Hopkins teaches a known benefit of detecting and identifying problems, providing more



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consistent processing, which allows better usage of the tool by minimizing time it is unavailable due to equipment issues.

As to claims 12 and 13, see discussion toward claims 2 and 3, above.

As to claim 14, see discussion toward claim 4, above.

As to claim 15, see discussion toward claim 7, above.

### ***Allowable Subject Matter***

Claim 10 and 16 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: Prior art does not disclose or suggest a method of detecting abnormal plasma leakage in a chamber wherein plasma leakage comprises formation of a region of secondary plasma in a location different from a primary plasma formation location.

### ***Response to Arguments***

Applicant's arguments/amendments, filed 01/24/06, with respect to: the 102 rejection(s) of claim(s) 1, 4-6, 8, 12, and 14 ; and with respect to the 103 rejection(s) of claim(s) 2-3, 7, 9-11, 13, 15-17 and 21 have been fully considered and are persuasive because Chen et al. of US 2004/0116080 fails to teach "detecting whether...by detecting an abrupt change", as defined in applicants' newly amended claims.

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Therefore, the rejection has been withdrawn. A modified rejection appears above to address applicants' new limitations.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patricia (Patty) George whose telephone number is (571)272-5955. The examiner can normally be reached on weekdays between 7:00am and 4:30pm.

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571)272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



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Patricia A George  
Examiner  
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NADINE G. NORTON  
SUPERVISORY PATENT EXAMINER  
